SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

No. 1836.—Vol. XL. LONDON, SATURDAY, OCTOBER 29, 1870. PRICE ..... FIVEPENCE. PER ANNUM, BY POST, £1 4s.

Original Correspondence.

COAL-CUTTING MACHINERY.

The many difficulties met with in the production of machinery for ...cutting coal have led to the abandonment of numerous inven...ns, which were found unable to stand the test of practical work...g. Amongst the few that have succeeded, and have been tested ...h most favourable results, may be mentioned that of Mr. F. Hurd, the Albion Iron Works, Wakefield, and which we have seen at ...rk during the last few days at the Wharncliffe Silkstone Colliery, ...r Sheffield. Before, however, stating what the machine actually ...s done, it may be necessary to state that the one alluded to has under...ne many improvements since formerly tested at the same place. ...ose improvements, which have just been patented, are in the joint ...mes of Mr. S. Firth and Mr. Hurd. Mr. Firth is one of the ...tentees of the well-known pick-machine, which has been in use ...r the last three years at the Ardsley Colliery, near Leeds, and, like ...r. Hurd, he has devoted a great deal of time to the subject of getting ...al by machinery. The patent relates not only to the coal-cutter, ...t also to the machinery for compressing the air by which it is ...rked. The improvements consist in connecting a series of cutters ...an endless rope instead of fixing them to the links of a chain, as ...Mr. Hurd's former patent; and by driving the endless wire-rope ...a friction pulley, with wedged-shaped segments fitting between ...es, and on a circular wedge; also in supporting the endless wire-...e or chain of cutters on flanged pulleys, mounted on the radial ...n, and in making the cutter-stocks in two pieces, secured to and ...closing the wire-rope. When the wire-rope was driven by the fric...n clip-pulley the rope was flattened where the cutter-stocks were ...ed to it, but when the wire-rope was not flattened it could be driven ...a toothed or notched disc on the fulcrum of the radial arm.

Another improvement related to the machinery for hauling or tra...rsing the cutting machinery along the face of the mineral, consist...r of a pair of friction-rollers placed diagonally to the rail, instead ...being at right angles thereto. The object of placing the rollers ...gonally was to facilitate the passing over the joints of the rails. ...e rollers were connected to a spring lever, which was acted upon ...a screw or other equivalent, the spring lever compensating for the ...qual thickness of the rails. When it was requisite to clear the ...ers from the rails the lever was moved so as to bring the rollers ...right angles to the rail, when they could then be raised by a screw ...otherwise. The patent also related to boring annular recesses in ...l or other mineral by an Archimedian shell screw-cutter, consist...r of a barrel with one or more threads, terminating in a cutter, or ...ters. The shell was turned by hand or power, and pressed into ...mineral to be cut; also, in driving excavating machinery by ro...y steam or other engines. The shell screw-cutter, when fixed to ...end of a thread, made a groove ¾ in., and left a circle of solid coal ...y) 8 in. in diameter and 2 ft. in depth. The holes were continued ...e to, or into, one another along the face of the coal. The coal ...that means would fall of itself. The improvements relating to ...machinery for compressing the air consisted in applying the power ...he longer arm of a differential lever, and in connecting the shorter ...n to the machinery for compressing the air, and in applying the ...ssure of air as a governor. As the pressure of steam in the en...es usually employed at collieries was not of sufficient force for ...pressing the air to work the excavating machine direct, the dif...ential lever was applied so as to increase the pressure on the air, ...ich was conveyed to a receiver, or direct to the excavating machine. ...re is also a self-acting governor, or self-registering pressure and ...ght gauge, by which the compressed air in excess of that required ...working the excavating machine can be seen, and conveyed back ...he motive-power engine.

The colliery where the machine, with its improvements, was tested ...the Wharncliffe Silkstone, the seam being the Parkgate, which ...bout 4 ft. 6 in. thick. The cutters were applied to a band of ...ne, so that the coal was just cleared by the groove made by the ...ters. The bank being worked was about 60 yards in length, the ...ps being 28 in. from the face of the coal. The machine itself was ...allel to the face of the coal, and was worked by one man. It cut ...way into the coal at right angles with the face to a depth of 3 ft. ...n., when the clips were brought into practical operation. The radial ...n then proceeds at right angles, and steadily moved along until the ...ire length of the bank was cut. The machine worked with the ...atest ease, and very steadily, without any roof pressure being ne...ary. When the machine was removed to another bank the clips ...e disengaged from the rails, and the arm turned back into a hori...tal position. The machine can be taken into any heading where ...re is a space of 25 in. between the face of the coal and the props, ...worked in any seam from 15 in. upwards. The work we saw it ...shows that from 8 to 10 yards can be cut in an hour, whilst Mr. ...RD states that an average of 80 yards at least could be relied ...n and guaranteed. That in the seam where tested would give ...ut 112 tons of coal per day, or in the Barnsley bed about 220 tons. ...far as the practical testing of the machine was concerned, there ...be no doubt whatever but that it was a great success, and already ...eral of them have been ordered for different parts of the country, ...lst its more general adoption is evidently only a question of time.

Another machine for cutting coal has also just been brought out ...Mr. C. Bartholomew, of Doncaster, and one of the partners in ...Wombwell Main Colliery, near Barnsley. The invention consists ...a means of getting coal by sawing, and is composed of two or more ...w-blades, parallel to each other, rivetted together, with space be...en them, in such a manner as to allow the dust made to pass ...dily away between the blades, and the teeth of the saw-blades are ...ed in such a manner as to remove a sufficient breadth of coal to ...bour the entire thickness of the saw. In working, a hole is first ...led into the coal the required depth of the groove intended to be ...de, making it an angle rather than to a perpendicular. The saw ...hen inserted, and worked to and fro by hand or by power; and ...rder that the saw may be made to bear with sufficient pressure ...inst the coal at either end of the cut, a fulcrum is employed, which ...xed in the cut behind the saw, and which is advanced as the work ...eeds. By the apparatus indicated, a saw-gate can be cut in the ...in any direction, either by manual power or mechanical action, ...when blocks of coal have been sufficiently cut round, they can ...orced off by the ordinary means.

...as Mr. Hurd asserts, that coal can be raised by machinery, in some instances at something like 8d. per ton less than by hand, those who are now adopting mechanical power will have such an advantage over those who rely entirely on manual labour, that the working by machinery will ultimately become general, and hand work the exception.

THE SHELTON BAR IRON WORKS.

In noticing the Shelton Bar Iron Works, about the largest in North Staffordshire, of which Earl Granville is the principal proprietor, and Mr. Roden, M.P., the manager, it may be of some little importance to allude briefly to the general condition of the trade in the county of Stafford. Not so many years since South Staffordshire was the leading district for the production of ore and pig-iron, but its deposits have been so fast thinning out that it no longer holds the position it did. It now has to import large quantities of ore to keep its furnaces going. North Staffordshire, on the other hand, has now immense stores of ironstone, black and clayband, and hydrated oxide, a good deal of which is sent into the southern part of the county, so that North Staffordshire gives promise of taking the lead in the production of iron, having the great advantage of plenty of coal in close proximity to the ironstone fields. That the position of the two parts of the county are such as we have pointed out will be seen from the following returns of the tonnage raised of iron and stone for three years, to which they have been made up :—

		1866.	1867.	1868.
Ironstone...	South Staffordshire .. Tons	593,000 ..	525,000 ..	304,578
	North Staffordshire.....	612,243 ..	794,509 ..	786,881
Pig-Iron.....	South Staffordshire	532,625 ..	515,638 ..	532,234
	North Staffordshire.....	210,335 ..	210,232 ..	229,913

The Shelton Works, which are situated and included within the township of Hanley, cover a large area of ground, and are divided into two parts, one being near to Etruria. The latter being the new portion, are admirably laid out, having the most efficient machinery and appliances for economising labour and fuel, and having a fine lofty corrugated iron roof over the mills, with a span of 120 ft., made by the Tividale Company. The Shelton Works are most extensive, and give employment to a very large number of hands. There are eight blast-furnaces altogether, four at each place, and producing about 1800 tons of iron weekly. At Shelton three of the furnaces are brick and one iron cased, all of them being about 48 ft. high. The boilers are double-flued and single tubes, and six in number. The material is taken to the top of the furnaces by means of incline lifts worked by a small engine. At Etruria the four furnaces are all iron-cased, on a brick base, and about 60 ft. high, and the waste gases from two of them are utilised for heating the boilers and stoves. The ore and other material used in smelting is conveyed to the top by perpendicular hoists. In connection with the blast-furnaces, it was found necessary, in order to avoid any back pressure upon them, to erect another to carry off the gases, so that there is now one at each end of the furnaces. The ore principally used is the local ironstone, calcined with an admixture of Froghall and others. The Froghall, which is a hydrated oxide, is brought a distance of about 16 miles. A good deal of the coke which is required for smelting is imported from South Wales and the North of England. There is plenty of coal in the district, North Staffordshire producing about 3,600,000 tons annually, of which 1,500,000 tons are used at the various iron works. Earl Granville has several large collieries close to the Shelton and Etruria Works, to which railways are laid down, and from which the works are supplied, there being five locomotives for that and similar purposes.

There are 100 puddling furnaces at work—66 at Shelton, and 34 at Etruria. At the latter place they are grouped in a complete crescent, and round the ordinary Staffordshire boilers, the smoke escaping into culverts underground in connection with two large stacks, the smoke from which—seeing that the works are close to the town—by means of the arrangement of the flues is greatly diminished. By the laying out of the furnaces as stated several important objects are gained, not the least of which is that the coal is conveyed to them, and the ashes removed from the opposite side to where the puddlers are stationed, so that they are not interfered with whilst at work.

The general machinery is of the most complete character, there being about 16 engines of different powers. At Etruria there is an improved blooming mill, by which the labour of several men is saved; and at both the works there are no less than six steam-hammers, averaging 3½ tons each, and made principally by the Lilleshall Company. There is also another mill, consisting of two cylindrical rolls, by which large flat bars can be rolled to any width required, as well as two small vertical ones, which can be so adjusted as to get the bars to any width, up to about 3 ft., made by Perry and Son, of Bilston.

For the production of the manufactured iron there are two rail and girder mills, one a 22-in. train, and the other a 16-in. train, together with two plate and three bar mills. The produce of the works are of a general character, comprising rails, plates, girders, bars, angle, and almost every other description of iron. It may be stated that at both places there are the usual workshops, including a foundry, fitting and machine shops, and all the mechanical appliances that are necessary.

The interests of the workmen and their families, socially and otherwise, are not overlooked, whilst the wages paid are about the highest in the district. Of the number of men employed at the works some idea may be formed, when we state that the wages which are at present paid on the whole concern amount to about 3000*l.* per week.

Furnaces.—Messrs. J. and H. Fisher, Birkenhead, in place of the ordinary bars, use a series of longitudinal bars of iron, or other suitable material, to form the fuel bed, and which bars they prefer should partake more or less of a T-shape in vertical cross section, the vertical limb, by preference, being slightly tapered from the junction of the cross-head towards the foot, and in some cases the under side of the arms of the cross-head are bevelled downwards, and sometimes the edges of the cross-head project beyond the junction of the head with the web, so as to form a groove in the under side of the head. The top is formed flat or curved, bevelled downwards from the centre or flat in the centre, and curved or bevelled towards the outer edges, or other suitable form of bar is used.

Treating Iron Ores.—By the invention of Mr. C. W. Siemens, Great George-street, cast steel is produced by the concerted action of two separate processes, the one serving to convert the raw ore into lumps or loaves of calcined, fluxed, and partially deoxidised material, and the other to smelt and convert this material with or without the addition of pig metal into cast-steel of any desired temper. The first or preparatory process is carried on in a furnace (by preference a regenerative gas furnace) resembling in form a copper smelter's or large puddling furnace, having charging doors at the sides or in the roof, and a door in front for withdrawing the smelted material into pig beds or moulds. This latter door, according to one arrangement, has its sill plate on a level with the bed of the furnace, but has false sills or bricks placed upon it for retaining the fluid material in the furnace until the completion of the operation, when this false sill or the bricks are removed, and the semi-fluid contents of the furnace are raked forward into moulds arranged in front of the furnace, or stoppered discharging apertures may be formed below the ordinary doors of the furnace. The beds and sides of the furnace are made conveniently of aluminous bricks resting upon iron plates, but refractory iron ore, as hematite, may be used with advantage in repairing the sides from time to time.

THE TRUCK SYSTEM IN SOUTH WALES.

Sir,—The recent enquiry at Cardiff by the Government Commissioners into the operation of the Truck Act in South Wales has revived to a considerable extent the once much-vexed question, and, consequently, a good deal of discussion has arisen in reference to it. That the truck system does exist in South Wales was abundantly proved by the witnesses that were examined; although it may have appeared, also, that it does not prevail to the extent it formerly did. Many of the larger establishments, such as those in Aberdare, Dowlais, and Merthyr, have abandoned the system for years past, and it may be said that in some of the more isolated districts chiefly is the existence of truck now found—places, as a rule, distantly removed from any town of magnitude or importance. Still this is not all the truth, for it must be admitted that the system of truck is even at the present time carried on in connection with some of the largest establishments in the Principality. Of course, the forms of truck are various, ranging from that under which the workman is obliged to take three-fourths, if not the whole, of his earnings to the company's shop, to another workman who is, perhaps, able to obtain about one-half of his wages in cash. In few cases, probably, is a man told pointedly that unless he spends his earnings in the company's shop he shall not be allowed to work in the company's works; but there is no mistaking the fact that all the hands are expected to be impressed with the belief that such would be the case. In the more extreme cases it has been shown clearly that men have not the option of obtaining provisions other than from the company's shop, for as a rule they receive no payment in cash, it being a rather curious fact that the men's earnings, generally speaking, only barely suffice to clear the account against them in the shop. Those whose wages average 5*l.* per month cannot get enough money to pay even their landlords their usual small rents, unless they can manage to work a certain amount of over-time. The principal currency in those cases are notes or cheques on the shop. On the other hand, again, where the men are partially paid in cash, if it is found by the accounts against them that they have not taken all their goods from the company's shop their "draws" are cut down, and they are supplied with notes instead of money. At some of the shops a good deal of actual coercion is undoubtedly exercised, while at others there is a sort of understood coercion, which is scarcely more agreeable, or less open to objection, than the former. The system is, in fact, as above hinted, carried on under numerous and various forms, many means having been resorted to the more successfully, as well as the less conspicuously, to violate and evade the Acts of Parliament which have from time to time been passed. For instance, at some works there is a pay office and a shop under the same roof. The men are, it is true, paid in hard cash, but by a certain monitor which points the "way in" and "the way out," they are led, as it were, by a secret passage into the very presence of the shopman who has "an account against them;" so that the money is no sooner put into their hands than it is taken out again. Again, at other places the shop is let at a high rent; and here it cannot be said that the shop is actually the company's shop, still there is an unmistakeable connection, and the proprietor or proprietors of the works derive, no doubt, considerable benefit from that connection.

It has also as well been abundantly proved that the principal circulating medium in the districts where truck is carried on is goods of various kinds, and that the same packages pass and repass through the people's hands. But all that notwithstanding, what are the arguments in favour of truck? Much effort was made in the examination of witnesses to ascertain the real feelings and opinions of the workmen themselves in regard to the system. Perhaps amongst the less providently disposed class of workmen the company's shop is held in favour, as, owing to their excessive dissipation, it would be impossible for them to subsist through the periods between pay-day and pay-day, which renders the shop to them a charitable institution, where they can get their wants supplied. But the rule is, without doubt, that wherever there is a steady and honest workman, at the forge or in the pit, he would much prefer that the system should be entirely eradicated. And is it not reasonable to suppose that he should? It is harsh dealing indeed with the man who is disposed to spend his earnings carefully and judiciously, not to allow him the privilege, which is his undeniable right, to lay out his hard-got wages in the cheapest market, instead of being compelled to pay 15 or 20 per cent. higher for his goods, just because it is beneficial to his employer that he should do so. Even if it were only the minority of the men, and that a small one, who were providently disposed, it would be wrong to continue an institution which must be repugnant to their feelings, and so obstructive to the carrying out of their better intentions.

Much division of opinion arose—and the evidence given on this particular question was decidedly contradictory—as to the practicability of weekly or fortnightly pays. The workmen urge the adoption of weekly pays; but the masters contend that such a system would not be expedient or practicable. A good deal, no doubt, might be said on both sides of the question, and there would not be wanting arguments on the side of the masters; but the difficulty is at once cleared up by the fact that the system is successfully in operation at some of the largest manufacturing establishments, not only in South Wales but in the world. At the Dowlais works, where but little less than 20,000*l.* is paid in wages weekly, the men are allowed to draw the whole of their earnings every week, excepting 5 per cent. or so, and monthly settlements are made. At Cyfarthfa, Plymouth, and Aberdare this exemplary system is even as strictly pursued, with quite as successful results. It is, nevertheless, contended that were the men to receive weekly cash payments they would become more excessively dissipated and improvident than they are at present. The argument, as far as its general bearing is to be considered, is quite devoid of truth; and to prove it so, it needs only to instance the vast improvement which has taken place in those large and populous districts which have been referred to, since the days when truck was prevalent there.

Notwithstanding the more numerous temptations, and the greater facilities for dissipation, which predominate in large manufacturing

towns than in comparatively isolated districts, it cannot be said that the workmen at Dowlais, Merthyr, or Aberdare are more drunken or less provident than the workmen at Ebbw Vale, Abersychan, or Pentyrch. There can, in fact, be no argument advanced in favour of truck that cannot be reasonably confuted; and it is, therefore, a matter of satisfaction that the enquiry has been held at Cardiff. Possibly the Commissioners may have carried their proceedings occasionally with a rather high hand, but it must be hoped that this will in no way militate against strict and sound legislation in the matter. There has undoubtedly been unscrupulous evasion of all past Acts of Parliament prohibiting the carrying on of truck, and it will tax the energies and ingenuity of our ablest statesmen to carry a measure that will be effectual in dealing with the question.

When the first Truck Act was passed it was believed that it would thoroughly eradicate the system from all the mining districts of the kingdom. But experience has proved quite the contrary, it being the easiest possible matter to evade nearly all its provisions. The task, therefore, before the Legislature is not an easy one. But if the members of the House of Commons do really with a will determine to put an end to the system, there cannot be much doubt but that they will have the ability to do so. Every mode of evasion which is now resorted to should be strictly prohibited, and the Act should be made of so general a character that any new schemes that might be invented to perpetuate truck, in some form or other, might be effectually stopped.

MENTOR.

THE TRUCK SYSTEM.

SIR,—When the Home Secretary consented during the last session of Parliament to appoint a Commission to enquire into the working of the Truck Act in England and Wales, he was probably aware, having represented Merthyr in the House of Commons, that in South Wales the law was openly violated, and a vast social cancer was forming in the heart of that most densely populated and most flourishing county in the Principality, Glamorgan. The evidence adduced before the Commissioners reveals a state of things which, when the report is laid upon the table of the House of Commons, will surely be tolerated no longer.

Most of your readers are aware that in South Wales, where the famous smokeless coal is raised, about which a smart debate was got up by Mr. Fothergill, the member for Merthyr, in the past session, there are vast iron and tin-plate works, employing men, as in the case of Dowlais and Cyfarthfa, by thousands: the former place paying something like 20,000*l.* per week in wages, the latter being the well-known works of Messrs. Crawshay, probably the richest commoners in the kingdom. Fortunately in these two cases the men are paid in weekly wages; but in some others, as at Tondu, Ebbw Vale, Abersychan, Pentyrch, and Treforest, the truck system prevails, and men are compelled to deal at shops in connection with the works, where the price of goods ranges from 10 to 25 per cent. above those obtainable from the local tradesmen.

The advent of the Commissioners naturally caused an immense "sensation" among those employers who were guilty of carrying on the abominable system, and one foreman of works was threatened by the Commissioners with a visit to Cardiff gaol for contempt. In another case a local lawyer insisted upon appearing for the proprietor of the Pentyrch Works, who is a magistrate and deputy-lieutenant of the county, but was ruled to be out of order; and a smart fusillade was kept up for some time by the lawyer and the Commissioners, resulting in the total discomfiture of the lawyer. In this case the Commissioners had visited the works, and had taken away certain books and memoranda under the powers they possess from the Crown; and the proprietor has since stated that if he had been present at their raid he should have instructed his servants to resist the removal of his papers. He now intends to proceed against the Commissioners in a court of law for exceeding their powers.

The drama unfolded in the Town Hall at Cardiff, where the sittings were held, reveals the total subjection of a class who are "expected" to buy at the company's shop in some instances (and we know what that means), and who in other cases receive goods in lieu of money, oftentimes to the extent of three-fourths of their wages. Tobacco in Ebbw Vale takes the place of money, and a workman can get sixpennyworth of ale for eightpennyworth of tobacco at almost any public-house—the tobacco in many instances finding its way back to the companies' shop, and thus passing to and fro between the workmen, the publican, and the shop. In consequence of the insufficiency of companies' shops, the poor wives of the workmen have to remain, in the depth of winter, it may be for nine or ten hours before they can be attended to; and fights, in which the weakest go to the wall, are the result. One man stated on oath that he had only received 1½d. in cash in a twelvemonth, while another affirmed that he could only get cash by working overtime! The masters, knowing that they are on the shady side of the law, cannot recover debts contracted at the shop, and men oftentimes leave in debt. It was feared that little evidence would be got in South Wales, because the men are a patient race, but they came boldly forward and told the Commissioners that the "sack" would be their fate for stating the truth. The masters and their managers, with the utmost assurance, said they could not pay weekly wages, because of the time and trouble entailed; but the Dowlais people ignore the difficulty, and prove their case by carrying the weekly payment system into operation. If the largest iron company in the world can do it, surely the smaller can do the same. In one case it was proved that as much as 11,000*l.* in the year was made by the sale of goods, although the Chief Commissioner had some trouble to elicit the fact.

The only bright spot in the system appears to be that the companies give good articles and good weight in most instances, but the practice is not universal, for in one case 2s. 8d. tea was sold for 4s., mixed with one-eighth of tea-dust. The governor of the county prison, who has had a large experience, stated as his opinion that the companies' shops were a boon to the wives and families of the drunkard, but a curse to the steady and industrious man. If the owners of the works did not derive a large profit from the shops, but sold a good article at a fair price, there would be little to be said against the system; but when, in addition to the profit derived from iron works, collieries, and tin-plate works, they net thousands by engrossing the whole, or nearly the whole, of the local trade, they become abettors of a system which the House of Commons will do well to "stamp out" at once. The master takes his bills in cash, and the men have a right to the same measure of justice. Many of the managers averred that if the men were paid weekly they would not get their orders executed; but the Lord-Lieutenant, Mr. Vivian, M.P., and the Messrs. Crawshay do not find such to be the case.

AN IRONMASTER.

THE RATING OF MINES, &c.

SIR,—I am just in time to glance over the letter published in the *Mining Journal* (which is our Mining Encyclopædia) of last week, but have not time to reply to one or two remarks which I wish to clear up. On the whole, I much admire the intelligence and ability of the writer, who has evidently a desire for truth and justice to prevail. I hope to be able to send you my few remarks on this subject in time for next week's Journal.

When in the Black Country last week I was taken by surprise by an old friend, who placed a printed form with a list of high names before me, headed by the Lord Mayor of London, calling upon the employers of labour throughout the country to sign a petition to Parliament requesting one uniform poor rate throughout the whole country; and many signed it without for one moment looking into the merits of the question. After a few minutes reflection, it struck me that nothing in the world could be more unjust than to tax property in the country which has none of the advantages of property in large towns to pay the poors rates of those who have so many advantages. I have no time to go into the problem just now, but in order to call the attention of your numerous readers to this subject before they commit themselves by signing the petition to Parliament, I beg to make a few remarks for the consideration of ratepayers in the country. First, tens of thousands of acres around London (and more or less in other towns) have increased in value within the last 50 years from about 60*l.* per acre to 10,000*l.* or 20,000*l.* per acre, and some to more than that; and we are now invited to help to keep the poor in such places where wealth has been so made, and will be so made to the end of our prosperity and growth of popultion. What share have country people in this plunder and high rents? The answer from all sides is no share at all; and the rejoinder will be let those who have the high rents keep their poor, who have a right divine, and a right, thank God, by law, to be provided for, when, by circumstances over which they have no control they cannot help themselves; and the bad must be punished, which is another charge upon property. People in the country have no interest in the wealth made in building in large towns, and ought not to take any part of the taxation. The paper I saw stated, if I mistake not, that we have 30 parishes which pay no poor rates. Our answer to that is, it is a great shame they are not connected with some unions adjoining them. In place of rating unions as now it would, perhaps, be as well to make the poor rate a county rate; this would cause a little alteration in the unions, but not serious; or, if occupied by the proprietor, on what it would be worth to rent. All funded property, and every share property—in fact, every property, lent money or otherwise, paying rent or income—should contribute to the maintenance of all the institutions of the country, local or otherwise.

It is not just to those who have had no share of the profits to say we will keep all the gain, but we wish you to take a part in our poor rates, &c. Did not the man who purchased the land, or leased it for building purposes, know at the time its obligations, and that such obligations may increase or decrease? And as long as the property is there it is only just to call upon the owner to contribute his share towards the maintenance of the poor in his district, and not call upon those to pay for him who have had no share of the profit.

I hope the people will look into this subject, and not act or take any part in it until they have given it their most serious consideration.

READER.

RATING COLLIERIES.

SIR,—It seems to me that much unnecessary complication is introduced in connection with the question of rating collieries, although the very fact of the landowner getting his rent in the shape of a royalty should facilitate the matter to the utmost. A colliery can only be valuable for the coal it contains, and the amount paid for dues should be taken as the exact equivalent of the rent paid for a house. In fixing the royalty to be paid, the owner of the minerals considers the damage that will be done to the surface, and also that when the coal is worked out the pit will be worthless. Why, then, should any deduction be made to compensate for the exhaustion of the corpus? I think if 6d. per ton royalty be paid, and 10,000 tons raised in the year, the rate should be upon 250*l.*, and there should be no rate upon the machinery employed for getting the mineral. There can be no difference for rating purposes, whether 250*l.* is paid by an agriculturalist for rent or by a coal miner for royalty, if that 250*l.* represent the amount paid to the owner for the premises occupied by the tenant.

If the royalty were regarded as the equivalent of rent, which it really is, I do not believe that even metalliferous miners would seriously object to the payment of poor rates and other rates, from which they consider themselves exempted by law, yet often pay, in consequence of the expense and difficulty of establishing their right. The taxation of the dues alone, and the exemption of all machinery and buildings employed for mining purposes, would encourage an important national industry, and give general satisfaction to—

Oct. 27. ONE AND ALL.

NEW ROCK-BORING MACHINE.

SIR,—The particulars of a new rock boring-machine, which will shortly be introduced to the public, will of course, be of interest to the readers of the *Mining Journal*.

Weight of stand, 40 lbs.; weight of cylinder, 30 lbs.; total weight, 76 lbs. Length from rear end of cylinder to piston-rod borer cap, instroke, 24½ inches. Outside diameter of circle embracing borer and stand, 9 inches. Pressure of atmosphere employed, 15 lbs. per square inch. Air required per minute, 6 cubic feet. Extreme length of stroke of piston, 5½ inches. Rate of boring per minute—in whinstone, ¾-in.; in hard rock, 1 inch. Rate of boring compared with hand-labour, 5 to 1. Room required in level for one machine, 5 by 6 ft.; for two machines, 6 by 7 feet. The borer is automatically turned by the rod of the actuating valve, which rod carries a small cross-head, fitted with a couple of pawls. These pawls operate on two ratchet-wheels, fitted to a horizontal shaft, which also carries a small bevel-wheel geared into a second wheel, the axis of which passes through the cylinder cover, and from thence into the head of the piston, turning the latter whilst it is in motion. The progression of the borer is performed by hand, for which purpose the cylinder is bedded on a light slide rest, and moved up and down by means of a flat thread screw. The slide rest-bed is supported at the rear end by two articulated rods, ¾ in. diameter, and which rods admit of being lengthened or shortened. Into the front of the slide rest-bed a bar, ¾ in. diameter and 12 in. long, is inserted, thus forming for the cylinder a light adjustable support, and giving the necessary facility for boring holes in shafts or levels. At the boring end of the cylinder a moveable hydraulic nozzle is placed, for discharging water into the hole. A self-acting differential piston-valve is fixed on the working cylinder, and near to the top of the latter. The inlet and outlet portways are formed in the smaller diameter of the piston-bar, whilst the piston proper is slightly recessed at its under and upper edge. In connection with these small recesses there is a port in the piston-case ⅛ in. diameter. Thus the bar valve is worked atmospherically, and is in mutual relation with the action of the boring piston. A portway extends from the front of the cylinder to the inlet cock. This boring-machine is characterised by its portability, applicability to tortuous levels and stopes, freedom from accident (since it is held in position by the attendant miner, and not fixed rigidly to a stand), simplicity of parts, and cheapness. It is employed at some of the Rhenish mines with considerable advantage, both in respect of time and cost.

X.

NEGLECTED MINES IN CORNWALL.

SIR,—The following setts in the best districts of Cornwall are well worth being carefully worked. I speak from a personal knowledge of them all, and have adventured in more than one. They are—West Stray Park, South Dolcoath, Union, Sparnon, and South Kitty. The first-mentioned is especially worth a vigorous trial. It is only about ¾ mile west of Dolcoath, is a large sett, and contains four or five lodes, only one of which was tried in the last working to the depth of about 100 fms. It yielded a fair quantity of rich copper ore, but the parallel lodes were never cross-cut, because the engine was too weak. At Wheal Union the only work going on is a cross-cut from East Carn Brea. At Sparnon they are working above the adit only. South Kitty was slightly worked a few years ago. ADVENTURER.

Oct. 26.

WHEAL, HUEL, OR MINE?

SIR,—It has generally been allowed that the word wheal means a mine, and is not a corruption of the word wheel. I have not seen the work mentioned by "Etymologist," but some manuscript in my possession gives the word wheal a very ancient origin, being formerly spelt huel, and more anciently gwêl, from the British word gwâl, a piece of ground set apart, a bed in a garden, a place of repose, a *repository*. Cornwall and Scilly were, no doubt, the cassiterides of Herodotus and Diodorus Siculus. The latter, who lived 40 years before Christ, gives an account of the tin works and tin trade of Cornwall. He mentions their raising the tin, refining it for sale, and carrying it to an island called Ictis, to which, at low tide, they could have access with carts. This, of course, refers to St. Michael's Mount. Phœnician merchants came to purchase the tin at the market of Zion—now Market Jew, or Marazion; it was exported into Gaul, and finally through Gaul, by a journey of 30 days, to the mouth of the River Rhone. Jews settled in Cornwall at a very early date, and in the reign of King John entirely engrossed the tin trade, but they were banished the kingdom in the eighteenth year of Edward I., and the mines became neglected for want of proper encouragement to labour, and security to enjoy and dispose of the product.

T. E. W. THOMAS.

WHEAL, HUEL, OR MINE?

SIR,—In answer to the enquiry of "Etymologist" as to the derivation and correct meaning of the word "Wheal," on reference to the Cornish-English vocabulary of Borlase "Huel" signifies a mine, and on reference to mining records at the beginning of this century I find the following instances of the word "Huel" being prefixed to the name of the mine:—

Huel Fanny, Huel Sparnon, Huel Unity, Huel Alfred, Huel Garland, Huel Jewel, West Huel Virgin, Huel Cock, Huel Damsel, Huel Maggot, Huel Towan.

This evidence I think is conclusive as to the ancient use and meaning of the word "Huel," commonly spelt "Wheal."

T. A. MASEY.

GOLD MINING IN WALES.

SIR,—The mine formerly known as the Gwynfynydd Gold Mine is situated on a group of hills to the west of the Mawddach river, in Merionethshire; and both the Mawddach and the Pistil Cairn run together until they empty themselves into the Barmouth Channel, which is about 16 or 17 miles from the mines. It appears from the reports of many different mine agents, made some years ago, that visible gold was discovered in fourteen different places within the sett. A short time since a fresh company—the New Gwynfynydd Gold Mining Company—took it in hand. These companies laid out much money in erecting large water-wheels, and providing the various plant and machinery necessary for the extraction of the gold from its ores. All things having now been completed, they are extracting fair quantities of gold. There is every prospect of their continuing to do so, but there must be care exercised not to be extravagant, or everything will fall into disorder. On the east side of the Mawddach river is the West Cwmheisian, where they have a shaft sunk to the depth of 40 yards. From thence a cross-cut is driven to cut the east and west lode, and a level is driven west for a considerable distance upon the lode, and under the Mawddach river, directly towards the New Gwynfynydd. For the present I shall confine myself more especially to the east mine.

Some seven years since a pamphlet was printed concerning both East and West Cwmheisian Mines, and accompanied with various reports; but it was at the East Cwmheisian that visible gold was first found. This was in Dec., 1845, when Mr. Arthur Dean, by powdering the debris, and washing away the refuse, obtained the gold in small particles, which were sent to Mr. George Brain, the owner of the mine. The East Cwmheisian is about 700 yards from the west mine, and is on a group of 14 veins, having many different bearings, the prevailing one being N.W. and S.E. The mine was originally opened as a lead mine, but a small quantity of very rich auriferous ore being discovered a few feet from surface, yielding from 7 to 16 ozs. of gold per ton of ore, induced an enquiry whether the present intention of working for lead should not be abandoned, and on further examination large quantities of the tinstone and ores, taken from the veins at distant points, gave valuable results in gold. The owner then determined to have it ascertained whether it were really to be considered a gold mine or a lead mine. The result was to prove that wherever the veins were opened they were found to contain ore both in depth and length, and that every kind of mineral contained in them is mixed with gold. For a practical test 300 tons were broken from all parts of the mine, and concentrated to 10½ tons of washed ore, which gave an average of 16 ozs. of gold to the ton of the washed ore. The strongest bunch of the precious metal was found in the part called the Victoria workings, by driving a tunnel at the East Cwmheisian.

The commercial value, however, of the gold deposits of Wales has never been thoroughly tested, by applying the same business-like care and energy that would be considered indispensable in other branches of industry.

SPECTATOR.

[ADVERTISEMENT.]

QUEEN—KING—AND THE VIRTUOUS LADY.

SIR,—In drawing the attention of investors to the advertisement respecting these mines, which appears in another column of the Journal, I would further claim the indulgence of your readers and the numerous shareholders who have interests in these properties; and beg them, since so many cannot pay the mines an actual visit, to accompany me by letter form, and inspect what I honestly believe are destined to rank, after proper development (which means sufficient and moderate time to be allowed for explorations), with England's most successful and best dividend-paying mines. As a preliminary introduction, I can confidently assert that every shareholder who has visited these mines has been, like myself, so confident of success that the result in each and every case has been a further purchase of shares.

After a pleasant drive of some seven miles from Tavistock, we arrive at the QUEEN, and Capt. Knott, the agent, is soon engaged, with his usual calmness and sound practical manner, in answering numerous questions put forth by eager enquirers; and, with his usual style, he imparts to his hearers the why and the wherefore of silver ore being found at the Queen; and, naturally becoming animated in his elocutionary discourse, introduces his old favourite text of there being in mining, like everything else, "a cause for every effect." We wend our steps to the silver-house, and are informed by the secretary that the silver ores sold since the formation of the company, July 1, 1870, amount to 591*l.* 19s. 10d.; and the agent, in answer to a question, states that the house now contains some 400*l.* to 500*l.* worth of silver, almost ready for the market, adding that the lode now being worked upon is worth 150*l.* per fathom, and his confidence that another 15 ft. driving will discover the rich bunch spoken of by him in his several reports. The silver ore already discovered has been raised to surface, and sold at four-fifths profit. An immense rock of silver ore is the admiration of all, and, in order to prove that it weighs as much as represented, it is placed in the scales, the result being exactly 84 lbs., Capt. Knott assuring the beholders, upon the strength of his 30 years' experience in silver mining, that it will not yield less than 20 per cent. of pure silver. Mr. Doble, the amalgamist, is at this point introduced to the party, and his practical illustrations, accompanied by the exhibition of several nuggets of silver, one weighing 9¼ ozs., the results of different trials upon a small scale of the poorer ores, at once convince one and all that as soon as the machinery is at work he will be able to return to good profit silver ores yielding as little as 12 ozs. to the ton, of which there are thousands and thousands of tons upon the sett.

We now proceed to the engine-shaft, and on our way notice a body of men busily engaged upon the erection of the steam-engine, the beam, and cylinder, different portions of which are already upon the ground. Here is one busy scene, and Capt. Knott is complimented upon the splendid manner in which the main engine-shaft is timbered, and the whole of the work of the mine carried out, which eulogy he richly deserves. A timid adventurer, looking with wonder down the shaft, enquires its depth. Capt. Knott replies, 60 fms. from surface, but that it is only in fork to the 40; at 20 fms. is the level, and 20 fms. deeper is the cross-cut, where the No. 2 lode has been intersected, and tin discovered. Two or three questions are now asked at once—Where is the tin? What did the old workers see at the bottom of the shaft? And why did they give up the mine? Our agent leads the way to a pile of arsenical mundic, some 4 tons, and places one or two stones in the hands of the shareholders that yield over 20 per cent. of tin, remarking that a fair sample had been taken of the bulk, and not picked, the result being a yield of 79 lbs. to the ton of stuff, or more than double the average of the tin mines of England. The reasons assigned for the giving up of the mine, after the shaft had been sunk 60 fms., are that the shaft was placed to take the lode at about 65 fms. to 70 fms. from surface; thousands of pounds were expended some 25 years since in getting to the 60, but funds ran short, and the breaking down one day of the wretched old engine put an end to the whole affair, and thus the lode has never been seen below the 20 (above which thousands of tons of copper and mundic have been raised and sold), until now cut in the 40, rich for tin. What will it be when intersected by driving in the 60? Our work at this point is necessarily stopped whilst the pitwork is being dropped, but six weeks hence the engine will be in motion, and the prosecution of the mine can then be carried on in earnest. The party now proceed to the whim-shaft, around which are piles of copper and mundic, some 500*l.* worth of which has been raised to surface by this company in the few months since its organisation. The value of the lode at this point in the 30 is—the western end, 6*l.*; the eastern end, 10*l.* per fathom; being driven at 4*l.* 10s., and stoped at 47s. 6d. per fathom. The immense profits here are shown at once; the piles upon the surface vary in value from 20s. to 3*l.* 10s. per ton. Captain Knott, in answer to a question put by the secretary, stated that the men at present engaged upon this lode, at only this one point, would break and raise to surface 100 tons per month now that stoping could be carried on, every month enabling the get to be further increased. A visit was now paid underground by those who were disposed to descend into the bowels of the earth, gratification and pleasure being visibly stamped on their faces as, an hour or so after, they re-appeared once more upon the surface.

A hasty visit is now made to the KING, which adjoins the Queen. The main shaft is cleared to the 20, and footway ladder placed, the men being engaged to clear up the shaft to the 40, or deep adit level, when definite plans will be arrived at for the effectual working and future benefit of the mine, and the spot decided upon for the erection of the engine. The agent stated that he could at once, if desired, break and return copper mundic to market, but wished to clear up the shaft first, and stated most emphatically that he considered the King would make every whit as good a mine as the Queen, and that the proprietors had every element of a speedy, certain, and lasting success. We wish our friend Capt. Knott *bon voyage* in his prosecution of the two mines, and have a parting salute from him, which was at once endorsed by the writer, "that apart from mechanical operations in the erection of the steam-engine, and the dropping of pumps, &c., every man employed in the mine, both on silver, copper, and tin, was more or less daily gaining a profit for the shareholders. Search England through and you will find that very few such mines exist."

We now proceed to the VIRTUOUS LADY, and are met by Captain Horswill, an agent of courteous disposition, practical knowledge, and good education, who conducts us to the tin workings, where some 60 to 70 tons of tinstuff are piled ready for stamping. Great surprise is experienced by the shareholders, who never anticipated this mine being so rich for tin, some of the picked stones yielding 50 per cent. of that mineral, the average of the pile estimated at 75 lbs. to the ton. The agent expressed great confidence that by Jan. 1 next 5 tons of tin would be ready for sale. Here, too, is active life; the carpenters are busily engaged in the erection of a new water-wheel and stamps, whilst the dressing-floors are being laid out, and miners employed in dropping the lifts in the shaft, the whole of the work pushing forward entirely for the tin department.

After a satisfactory examination of the tin lodes the secretary proposed a walk to the copper department, a pleasant walk of about two miles through the most picturesque and charming scenery of its kind in England. As we descend into the valley one rapturous murmur of delight and applause runs through the whole party, for the old and original Virtuous Lady is now seen in the distance, the mine at surface, with its machinery, adding little touches of art, blending magnificently with the lavishingly displayed hand of Nature.

The day is waning, and we must, unfortunately, pay a flying visit (I have to write hurredly, as post time is nearly up). Several dressing-floors are passed, everything being made ready for the immense deposits of ore that are honestly expected. We wait just two minutes to look at two water-wheels—one for pumping and hauling, the other for crushing the ores. This is the third wheel upon the property, and so great is the fall that the same water passes over them all. And now for the grand sight; we make for the south level, and inspect one of the richest copper lodes ever discovered in England, and have no occasion to put on underground clothes, as it can be witnessed without even soiling our feet; it was valued last week by Capt. Goldsworthy (engaged by one of the shareholders, and the writer knew nothing at all about it) at 70*l.* per fathom for the width of the end. Since then we have driven south, and there is no sign of the wall of the lode, but a rich course of ore wherever we work is before us. There was not time to go down the main engine-shaft, but Capt. Horswill showed

some native copper, which was in the joints of the killas in the cross-cut south, and everything denotes a rich lode ahead; the same lode that we have just seen, only some 20 fathoms deeper.

I now hurriedly proclaim to the world that this romance or imaginary visit of all the shareholders is founded upon sterling facts, and the present actual discoveries most assuredly do at least denote that we are about to have, as I have always predicted, in the Virtuous Lady one of the richest copper mines in England; and I say confidently that, at the present prices for which the shares of the three mines can be obtained, there is not such another certainty of making money at present before the public: 20*l.* will buy five Queens, five Kings, and five Virtuous Lady Mine shares, all fully paid up. The Queen is giving dividends already of 1*s.* per quarter, which is 5 per cent. per annum upon the entire outlay of the 20*l.*; and within six months after the starting of the engine, we shall be able, I believe, to pay 5*s.* per quarter. The King Mine has just as good a prospect, only not so far advanced; and if the present discovery in the Virtuous Lady holds on, and there is no reason to doubt it, and there are other important points to follow shortly, independently of this, a few months will see this mine upon the Dividend List.

A visit to these three properties is only wanted to prove the veracity of all my statements, and an ideal inspection is far below the real, as words cannot express the real riches and prospects of these mines. T. J. BARNARD.

Tamar House, near Tavistock, Oct. 27.

WHEAL GRENVILLE—SOUTH CONDURROW.

SIR,—Your Journal of Saturday last contains particulars of the South Condurrow Mine meeting, at which the manager of the mine made some remarks to which I shall be glad if you will allow me a brief space to reply. Mr. W. C. Vivian, in answer to a question, stated "the best lode in Wheal Grenville was dipping into South Condurrow at the rate of 4 feet in a fathom." This is incorrect; *all the lodes in Wheal Grenville are dipping south, or away from South Condurrow.* The only mineral vein we have underlying north, or towards South Condurrow, a branch met with sometime since in our 80 cross-cut.' When first discovered we called it a lode, but our agents are now satisfied that it is simply a "dropper" that will fall into the South Condurrow main lode in Wheal Grenville sett. The back of our main tin lode runs through a portion of the eastern part of South Condurrow, and is probably the lode they have lately discovered to the west of Frazer's shaft, but the lode underlies south into East Wheal Grenville, in which mine it will be intersected by the 120 fm. cross-cut north.

Mr. W. C. Vivian also said that "when the South Condurrow lode went into Wheal Grenville they would be welcome to have it"—implying that the lode is not likely to be found in Wheal Grenville. In the western part of South Condurrow the lode has a very rapid underlie south towards Wheal Grenville. At the 71 fm. level the cross-cut to the lode was 15 fathoms. At the 82 they have already driven 28 fms., and the main part of the lode is still before them. This cross-cut is now within 16 fms. of Wheal Grenville boundary, and at this rate of underlie the lode will be out of South Condurrow and into Wheal Grenville, if not at the 90, certainly before the 100 fm. level is reached. We have known this rapid underlie for months past, and are pushing on a 110 fm. level with view to intersect the lode. From the rapid inclination of the lode it will probably overtake our main lode in depth, and the two become united in Wheal Grenville sett. That there is a very fine tin lode in South Condurrow there cannot be two opinions, and that to the westward it will fall into Wheal Grenville, whilst the lode to the eastward will fall into East Wheal Grenville, anyone who will take the trouble to look into the question of the boundary, and the direction and underlie of the lodes, will at once see there is scarcely the shadow of a doubt.—13, *George-yard, Lombard-street, Oct. 27.* JOHN WATSON.

WHEAL GRENVILLE v. SOUTH CONDURROW.

SIR,—I expect that I am not the only shareholder in Wheal Grenville who feels the utmost astonishment at the unqualified assertions of the manager at South Condurrow to the effect—according to the report of the meeting in last week's Journal—that the best lode in Grenville is dipping into South Condurrow at the rate of 4 ft. to the fathom; and also that the South Condurrow lode was not likely to be found in Grenville, or words to that effect. If this be the case those who have purchased shares in Grenville upon the assumption that the South Condurrow lode will be shortly intersected in the former sett have apparently reckoned without their host. But is it so? Have not we, as Grenville shareholders, the strongest evidence that the South Condurrow lode will shortly cut in our sett? Why did South Condurrow cease to drive the 90 end? Why are the managers for a long time past been ominously reticent upon some cardinal points? Is it not because that to speak would be to disclose; but is it not equally evident that silence is more significant than utterance? It is to be hoped, however, that the Grenville committee of management will without delay take means to have this all-important question set at rest, for either Grenville shareholders are building hopes upon a baseless foundation, or the statement of the manager of South Condurrow is incorrect.

Oct. 25. A SHAREHOLDER IN WHEAL GRENVILLE.

SOUTH CONDURROW MINE.

SIR,—I have to thank "A Co-Shareholder" for his timely advice through the medium of his advertisement in last week's Journal respecting this mine, and the intimidations of jobbers and dealers, who are everywhere and always ready to tender "private and confidential" advice, and more especially those who are guilty of the acts of that ferocious animal the "bear." It is well known that many unfair means are being adopted to depreciate the market value of these shares, with the object of securing them at the lowest possible price; but I would suggest to the executive, unless he is one of the tribe, the urgency of pointing out to the shareholders the importance of the very encouraging and satisfactory report of the managers at the meeting on Thursday last, and none, not even the agents who have been underground for outsiders, have attempted to disprove one word of the reports.

It is hoped that shareholders will not be frightened out of their shares, which will, no doubt, be doubly increased in value during the next month or two, when the returns of tin come to be made known. A SHAREHOLDER.

[For remainder of Original Correspondence see to-day's Journal.]

A PROGRESSIVE SERIES OF POPULAR LECTURES ON GEOLOGY.—LECTURE II.

At the opening of our last lecture we showed that geology was a progressive science, which must be dealt with step by step. It may, therefore, be well that we should, at the commencement of each successive lecture, give a short epitome of the previous one, in order that the casual reader may be enabled to take up any lecture of the series, and read it as an intelligible whole, without being obliged to look back at what has gone before. Our attention in the last lecture was drawn more especially to the several divisions of the subject of Geology, and, under the consecutive heads of Mineralogy, Lithology, and Petrology, we found—

1.—That our earth's crust is, in the main, composed of twelve chemical elements, which combine together to form certain minerals.

2.—That these minerals combined together in different ways form the various rocks.

3.—That rocks owe their origin to the action of water or fire, and are called stratified or aqueous, and unstratified and igneous, according to the nature of their origin.

And, lastly, we explained shortly a few of the striking features common to rocks in their construction.

In this lecture our first object will be to consider the formation of soil. It is exceptional, as we know, to see bare rock on the surface of our earth; but how did it become covered with the coating which we call soil, so necessary to the production of the fruits of the earth, and which by the vegetation it encourages gives to the face of nature the refinement of elegance and beauty? We arrive at the solution of this question just in the same way as we discovered the origin of the rocks themselves. We then saw that certain existing forces, which we knew to be actually working, were producing certain definite results, and hence we attributed similar results to similar forces. As is the case before us, by exactly the same reasoning, we arrive at the conclusion that the so-called covering of soil is simply the upper portion of the original rock, broken up and powdered by various agencies, whose actions we can readily trace; and we see that these agencies are daily and hourly producing soil similar to that which has been produced during bygone ages, and which now covers the surface of our earth. Our present object is to consider what these agencies are, and how they do their work. In this much-loved and much-abused country of ours, with its frosty night and showery morning—its cutting east wind and its scorching sun, we are afforded ample opportunity of watching the effect of these various agencies, and of seeing them in action one after the other in rapid succession. We may enumerate them as follows, and then deal with them one by one, pointing out the work done by each, and the manner in which each helps the other. These agencies are—frost, rain, sun, wind, lightning, seas, rivers, landslips, and trees.

Let us begin with rain, as, perhaps, the most universal and the most common in this country. We little think, when looking gloomily out of the window, wondering when the rain will stop, or when enjoying the freshness of the garden after the April shower, of the great work which that rain is carrying on. How that slowly, but surely, it is helping to alter the face of our earth—each drop does its work, by carrying down its particle of pre-existing rock, in the shape of mud, silt, or sand; first into the nearest gutter, which eventually opens into a ditch, and this into a stream, gradually increasing its dimensions to those of a river, which at the end of its course deposits the particle of rock originally carried down by the drop of rain at the bottom of a lake or sea, there to assist in forming a new covering of soil or layer of rock. This work, as we know from much in-door experience, goes on to a great extent in the month of November, and is followed by the sharp and sudden *frosts* of December and January, in alternation with the damping *thaw;* the effect of these sudden changes being often seen in the broken water-pipe, and, consequently, dripping ceiling. But rocks, as well as water-pipes are liable to break under the influence of contraction and expansion, so that frost and thaw tend to crumble them up, and prepare them to be carried off by the rain. But frost engages in a work far grander and more noble than the bursting of water-pipes and the crumbling of rocks. Let us turn for a moment to the regions of eternal snows, and where frost exercises undisturbed dominion. We find there the *glacier*, miles in length, and hundreds of feet in thickness. The snow, by the extreme pressure of its enormous mass, and the freezing of the water after partial thaw under the influence of the sun's rays, having been converted into this so-called glacier or slowly-moving river of ice—for it has been found on careful observation that glaciers have a very slow, but still a constant, downward motion. Their share in the work of denudation is very great, and of a threefold character. First, they carry down with them large masses of disintegrated rock, which have been loosened and dislodged from the adjacent mountains, and, rolling down, have formed on either side the glacier what are called "Lateral Moraines." It often happens, too, that a glacier is divided into two branches by a mountain ridge, and then a similar "Medial Moraine" will be formed at the foot of the ridge—and at the bottom of the glacier the lateral and medial moraines unite to form a "Terminal Moraine," the rocks and stones of which are ground down and carried off by the rivers of water constantly rushing through all glaciers, the ice being melted during the hottest part of the day. Besides these moraines, however, rocks frequently fall into the crevices and fissures of the glacier, and, being frozen into its under surface, act as cutters over the bed of the ice-river, smoothing down rough surfaces, and leaving rounded knobs and hillocks. The third species of work is effected by the iceberg broken from the glacier, which floats out into the ocean, carrying with it its load of rock and stone—and as it gradually melts its passengers are dropped one by one thousands of miles, it may be, from their original home. Holland affords a striking example of the work done by glaciers, nearly the whole of it being formed of *glacier substance* from the heights of Switzerland, and again in the highlands of Scotland distinct traces are still seen of the *rounding* work of the glacier cutters. Thus, we see the vast work carried on by the influence of frost; but we must hurry on to treat of the other agencies, scarcely less wonderful, and often more effective, in their work—and among these the *chemical* power of rain as a denuding agent is not inconsiderable in dissolving the carbonate of lime from chalk, and leaving behind only the flint and earthy matter; and, inasmuch as chalk is almost pure carbonate of lime, many *feet* of chalk must be dissolved in order to produce a single *inch* of flint and earthy matter. Hence we see that rain must do a great work in this way, for we generally find over a sub-stratum of chalk a considerable thickness of soil, formed of flint and earthy matter. Rain is also the primary cause of *landslips*, whereby vast masses of the crust of our earth, sometimes miles in length, are detached from their original base, and hurled into new positions, so as entirely to alter the face of nature. Let us imagine a stratum of rock having a stratum of thick impervious clay beneath; the rain in falling sinks into the cracks and fissures of the rock, but is checked by the impervious clay, till at last the force of the collected water becomes so great as to loosen and carry down the masses of rock above it, and so the landslip is brought about. The action of the *sun* may be seen in any ploughed field after heavy rain; the soil shrinks, dries, and cracks beneath its rays, and what is here distinctly seen within a limited area is carried on to a greater or lesser degree over the whole surface of the earth. The effect of lightning is, as we know, sudden and tremendous. The stern and rugged rock, which refuses to yield to any other power, is shivered into dust by a single flash of this irresistible power. Similar, though much more quiet and gradual, is the effect produced by *trees*, which strike their roots deep into the earth, obliging even the hard rock to yield to the determined efforts of their spreading fibres. Not so apparent is the effect of *wind*. We know that it blows about the dust, and dries the ground; but we may not at first observe that it makes use of the dust to cut and wear away the rock against which it is blown—so that we often find rocks narrow at the base and broad at the top, the hollowing out of the lower part having been produced by no other agency than the cutting power of the dust blown against it by the wind.

We have now to consider the work done by seas and rivers, and the manner in which this work is accomplished. With regard to the sea, its workings are now limited entirely to the coast-line; but there was a time, as we know, both by scriptural revelation and geological research, before the dry land appeared, when the waters held unlimited sway; but we will confine ourselves to the state of things which has existed since a boundary was given to the sea by the command—"Thus far shalt thou come, and no further." Great changes have been brought about since then by the agency of the sea, which may be explained in the following manner:—We see the waves dashing upon the shore at one time close up to the cliffs, at another it may be a mile or more from them, according as it is high or low tide. Now, this action of the waves is felt only on and near the coast line, for in deep water the bottom, though often affected by under currents, is not disturbed by the motion of the waves. The effect produced by these waves constantly dashing against the shore is to undermine the cliffs, not only by continual wearing of the water, but often by the battering of rocks and stones against them. The stormy West Coast of Ireland affords a striking instance of the work done by the sea. Tides, also, have their special work, which is to reduce the land to a mean level between high and low water. Thus, in some places we should expect to find the sea encroaching upon the land, in others to find land being produced by the action of the sea—and this we know to be actually the case. The work done by rivers, though left till last, is really, perhaps, the most important and extensive. We have already seen how they assist the little drop of rain by enabling it to carry down its infinitesimally small load of dust; and, insignificant as this may appear, yet the work accomplished in this way is great beyond all conception. Not only is this suspended matter eventually deposited to form vast continents of land, but while passing down the river it cuts away the banks, pure water having but a very small cutting power. To give a tangible idea of the work done in this way we may mention that the debris brought down in the form of particles of dust, and deposited by the Mississippi yearly, has been calculated to be sufficient to bury the whole of modern London to a depth of 14 feet, and that the delta, or promontory, formed by the Mississippi in this way during many hundreds of years, which has been accurately surveyed, is found to be 12,300 square miles, with a known depth of 600 ft.—how much deeper no one can say accurately. It is quite possible that the whole depth may be 1200 or even 1800 ft.; but, even supposing it is only 600 ft. deep, this quantity of silt and sand would be sufficient to bury the whole of Great Britain to a depth of 100 feet. When we consider that this is the work of only one river we may form some idea of the enormous results produced in this way. Then, again, rivers in flood do wholesale work in carrying away vast rocks. Examples of this are frequently seen in India after the heavy rains. One such may be specially noticed, which occurred in the year 1866, when 20 inches of rain fell in 24 hours, and swept away a mass of rock weighing 80 tons. *Waterfalls*, again, do a great deal of additional work in wearing away the surface over which they fall. The Niagara offers a striking example of this, where it is distinctly proved by the nature of the country through which the river flows, that in the course of years, the falls must have receded a distance of 40 miles. The river flows upon a bed of limestone, with a soft stratum beneath it, and the spray from the falls has gradually eaten away the under stratum, till portions of the upper limestone, being left unsupported, have broken off; this work has gradually progressed till a length of 40 miles has been eaten away.

At this point we may close our subject for the present. In the next lecture we shall hope to show how the material thus swept into lakes and seas forms rocks.

[*Silified* should have been printed *vivified* in the first lecture.]

THE GEOLOGY OF PORTSMOUTH DOCKYARD.—In connection with the excavations made in carrying on the works at Portsmouth Dockyard, Prof. J. MORRIS has recently given a very interesting account of the geology of Portsmouth generally, chiefly, however, confining his observations to a detailed account of the strata exposed by the deep and extensive sections laid open during the works for the extension of the Portsmouth Dockyard. The strata, exposed to the depth of about 50 ft., consist of the London clay series, overlain by gravel and a modern alluvial deposit, nearly similar to that now forming in the harbour. This upper bed of stiff clay varies in thickness from 2 feet to 30 feet, and contains shells of existing species, such as more usually characterise estuarine deposits, associated with much lignite and trunks of trees, and is merely an exposed portion of similar accumulations now in progress in the surrounding area. Below this is a bed of flint gravel, similar to that found in the neighbourhood, and this overlies the London clay, in which, over a large area, the works are now carried on. This deposit consists in the upper part of brown clay, with nodules of septaria, below which are beds of sandy clay, with large nodules of sandstone, full of fossil shells, characteristic of that formation; still lower are other beds of clays and sands, with septaria and shells, but the entire thickness of the series has not been fully exposed, although in a boring made at the works a considerable further depth was reached, but not the base, which overlies certain clays, which separate the London clay from the chalk, and which are seen to come out below it in proceeding towards the Portsdown chalk hill. The exposed portion of the deposits are very interesting, as showing by their fossil contents beds in immediate opposition of nearly similar mineral character, and which might be considered of the same age, but differing considerably in their contained remains, thus indicating very different periods of time. Besides which, the fossil shells show the conditions under which the strata were deposited, indicating zones of quiet formation, as many of the shells were seen to occupy the same position in the clay which they did during their living condition, a proof that the beds were not rapidly deposited, and that none of the subsequent changes have obliterated their original position. Altogether the sections are very interesting, as showing further that the two clays now superposed are of very old ages, and show very different climated conditions; the upper alluvial clay quite recent and temperate in character, the lower, or London, clay indicating deposits in an ocean having a tropical or sub-tropical temperature.

LARGE QUANTITIES OF TIN IN TENNASSERIM; MR. HENWOOD'S WORK ON METALLIFFEROUS DEPOSITS; AND SUBTERRANEAN TEMPERATURES.

The *Cornish Telegraph* gives the full text of the address of Mr. H. SEYMOUR TREMENHEERE, the President of the Royal Geological Society of Cornwall, at the annual meeting of that institution, on Friday, and from it we extract the following. The literary and scientific part has points of interest for miners everywhere; the notes on the stanniferous deposits of Tennasserim have a value for all producers and consumers of tin:—

TIN IN TENNASSERIM.

A subject has been lately lately revived in London which may very probably touch closely the interests of this county. This consideration justifies me in recalling to your recollection what is somewhat of an old story as regards this society, but which has been re-invested with a present interest.

In the 6th volumn of our "Transactions," published in 1846, is a paper by Sir Charles Lemon, Bart., our then president, containing some introductory remarks by him upon, and several extracts from a paper by my brother Major-General George Boriase Tremenheere, written by him when a captain (Bengal Engineers), and executive engineer of the Tennasserim Provinces. My brother was at that time (in 1841) called upon by the Bengal Government to examine, and report upon, the mineral resources of Tennasserim. He visited all the tin localities then known, and some which had not been brought to notice before. His report, on being presented to the Lieut.-Governor of Bengal was, by his order, printed in the "Journal" of the Asiatic Society of Bengal. This report came into the hands of Sir Charles Lemon, and was thus brought to the notice of this society.

It is a "Report on the Tin of the Province of Mergui, in Tennasserim, in the northern part of the Malay Peninsula." The Tennasserim Provinces (Martoban and Tennasserim) are parts of the Burmese territory, which was ceded to us in 1826. The Burmese had, in past times, taken it from Siam. While in possession of the Siamese the country had for ages been worked for gold, silver, and tin. Mount Ophir, from which gold found its way to Jerusalem in the days of Solomon, is in the southern part of that peninsula.

There are records that tin was worked in the year 1687. The Burmese neglected it, but the Siamese had carried on extensive works, the evidences of which still remain, in pits 8 to 12 feet deep in the beds, or on the banks, of streams, traceable for many miles along the line of several tributaries to the Great Tennasserim river, which passes into the Bay of Bengal at Mergui. My brother examined four of these tin grounds, all very accessible and at short distances (the furthest two days' march) from the banks of navigable rivers. At one spot a native, under his direction, collected 11,889 grains of tin ore in the course of an hour and a half. My brother states that the process by which it has been deposited for long periods, and for many miles along the line of the valleys through these streams which flow from the primitive mountains in the immediate neighbourhood, appears to be in active operation at the present day.

Besides the stream tin, he found a rich vein of tin in the side of an isolated hill, about 11 miles from the town of Mergui, consisting almost entirely of decomposed granite. The crystals of pure peroxide of tin were there in great abundance, imbedded in pure kaolin. The vein is 3 feet wide, and was reached about 5 feet from the surface; it is about a ¼ of a mile from the creek communicating with the river, and accessible by boats. My brother states that "in about a quarter of an hour a few baskets full of decomposed granite was removed down the hill, and washed, and yielded 63 ozs. of pure tin." My brother sent home to the India House 12 cwts. 38 lbs. of this ore, and the stream tin from the other localities. It was deposited in the Museum of the India House, and a considerable quantity of it is there still. Some specimens are in the Museum in Jermyn-street; these have been recently analysed, at his request, and have been found to contain from 55·18 to 72·95 per cent. of tin oxide.

In another locality in the Province, on the Pakchan river, near the southern boundary of the Province, about a couple of days' steaming south of Mergui, some Chinese, as my brother informs me, have for some years past been raising tin successfully, their produce being sent either to the Straits or to Mouimein in junks. It is understood that their "sett" expires in about two years; and it is, I believe, this circumstance which has brought the question of the Tennasserim tin grounds to the notice of some scientific persons, and of others engaged in commerce, in London, and revived the recollection of my brother's report. Mergui is a town of upwards of 12,000 inhabitants; its climate is described as "excellent" and as agreeing well with Europeans; its roadstead is protected by a fine island not a mile from the coast. Labour and supplies are abundant. Its situation would, in case of its becoming a place of export for tin, give it a great advantage over the Straits. It is 12° N. latitude. Singapore is in latitude 2° north, and the islands of Banca and Billiton, the principal sources of the Straits tin, are in lat. 5° to 8° south.

Being in possession of the facts I have just submitted to you I have felt that they bore directly, and with no little force, on the question which this society has now most prominently before it. (Hear.) Our main object now is to promote branches of scientific instruction in which this county is most concerned. (Hear.) The aid of science is now more than ever required to enable our mines to bear up against the competition which is everywhere on the increase against them. Many of us remember the apprehensions excited in the county when it first was seen to be probable that large quantities of copper would reach this country from the other side of the Atlantic. (Hear.) We all know the results to this county of the vast importations that have long since been regularly flowing in from that part of the world. (Hear.) It is from the eastern seas, and principally from the Dutch settlements, that tin has yearly to look, with somewhat anxious anticipations, for its competitor. There seems to be no reason why, from our own provinces, that competition should not before long be greatly increased. There appear to be all the elements of a large production, with security for capital, cheap labour, and easy communications, to call it forth. Surely these considerations afford additional reasons why every aid that the cultivation of science can afford should be sought for, through a more general diffusion of exact scientific knowledge, to cheapen the cost of production, and to enable the mines of of this county to keep their place against the world.

MR. HENWOOD'S LITERARY LABOURS.

In the mean time, however, a circumstance has occurred which I was enabled to foreshadow in my last year's address,—a circumstance affording us much encouragement and materially brightening our financial prospects. Mr. William Jory Henwood's elaborate work, which will form the 8th volume of our "Transactions," is completed and now lies before me; (applause)—completed, at least, with the exception of a small portion of the index, accidentally delayed in the hands of the printer; but there is every probability that the work will be ready to go into the hands of the Society and the public before Christmas. (Applause.) It will form the second portion of Mr. Henwood's great and well-known labours. His first volume was the 5th of our "Transactions," and was published in 1843. Its subjects were the metalliferous deposits of Cornwall and Devon; observations on subterranean temperature in the mines of Devon and Cornwall; electric currents in rocks and veins; with notices of the amount of water in Cornish mines; and much valuable statistical information. (Hear.) It has, as we all know, procured for Mr. Henwood a high name as a scientific enquirer. (Hear.) This, his second volume, is on metalliferous deposits, and on the working of mines and their results, with an appendix on subterranean temperature. It is the results of 12 years of unremitting labour. In my last year's address I called attention to the immense scope of enquiry which it embraces, extending from the narrow range of his first volume to the mineral districts of almost the entire globe; treating, as it does, of metalliferous deposits in North-Western India, in Chili, Brazil, British North America, the United States, France, Spain, as well as of those in our our country.

I shall invite your attention presently more particularly to the appendix on subterranean temperatures, as a matter of peculiar interest in this county; but, for the moment, I wish you to look at the volume with me in regard to its probable financial results to the Society.

According to the agreement long since entered into by the society and Mr. Henwood with the printer, 400 copies were to be printed; of these the society will possess 200, Mr. Henwood 100, and the printer 100. Of the society's 200 copies, a few must be sent to the societies with which we interchange "Transactions." The remainder will be for sale to the members of the society and to the public. Your Council has recently had before it a statement of the cost of the volume to the Society, which will, for convenience sake, be bound in two parts. The cost to the society of the volume so bound will be 1*l.* 5*s.* At this

price it is now offered to members, and our treasurer has prepared a book in which any member now, or hereafter, wishing to have a copy or copies may cause his name to be entered.

As regards the number of copies which may not be required by members, we have opened a correspondence with one of the principal London publishers, and there appears reasons to anticipate that the negociation may end in his taking all the copies we can spare off our hands at a certain price. (Hear.) The price to the public will, of course, be above that to members. We are disposed to hope that our 200 copies may before this time next year have supplied us with the means of nearly, if not entirely, extinguishing our debt. (Applause.) It will then be for the society, and the public both of this town and of the county, to consider whether they will proceed to furnish us with the remaining 200*l.* or thereabout, which I have shown to be required, if we are to make the great opportunities possessed by this society available for purposes of sound scientific instruction in the manner proposed. (Hear.)

Mr. HENWOOD ON SUBTERRANEAN TEMPERATURE.

I said just now that I should venture to refer more particularly to the substance of Mr. Henwood's appendixes (Nos. 1 and 2,) containing his observations on subterranean temperature.

The subject has long been regarded with great interest in this county, on account of its bearing on deep mining operations. In order to a correct appreciation of the value of Mr. Henwood's contribution in this volume to the knowledge of the subject, a short retrospect of its history is necessary.

During upwards of 30 years past it has been largely illustrated in our "Transactions" by the enquiries of Mr. R. W. Fox, Dr. Barham, Sir John Forbes, Mr. Moyle, and of Mr. Henwood himself, in the course of long and careful observations in this county. Of what has been done in France and Belgium, by very distinguished enquirers, as also in our deepest coal shaft in Cheshire, a most interesting summary was given by Mr. Warington W. Smyth in his address as President of the Geological Society, in which he added the result of some of his own observations in this county, as well as a *resume* of the enquiries of Mr. Fox and Mr. Henwood. To the facts thus brought under review by Mr. Smyth, in the localities above-mentioned, Mr. Henwood has added a large series of others, collected in very opposite and distant parts of the world—in Chili, Brazil, the United States, the Channel Islands, Ireland, Shropshire, and some further observations in Cornwall. An additional interest attaches to those made in Chili and Brazil—first from their having been in the Tropics; next from their having been made in localities several thousand feet above the Pacific—in Chili at an elevation of 3650 feet; and in four places in Brazil at elevations of 3250, 3300, 3360, and 3400 feet respectively.

Among the main facts brought out by all these enquiries has been that an increase of temperature with increasing depth is everywhere recognised. But great uncertainty exists about the rate at which the temperature advances in descending. The doubtful points are whether there is a regular scale of progression increasing directly with the depth; or whether it is intermittent, or varying with the depth; and to what extent it is affected by the different classes of rocks and different mineral deposits. Very interesting summaries are given by Mr. Henwood (p. 751) of mean depths, temperatures, and ratios in which the temperatures increase with the depths; and of the mean depths, temperatures, and rates at which the temperatures increase with the depths of the mines which yield different metals and ores. The results under other combinations of metals, ores, and rocks (p. 757-9) in the mountainous ranges of the tropics, and in the less elevated parts of temperate regions,—showing great variation in the ratios in which the temperatures increase with the depths,—are, I venture to say, of great interest. (Hear.) Mr. Henwood draws attention to an apparent anomaly sometimes found in subterranean temperatures, as to which he invites further enquiry. Here and there it is found that "portions of various rocks and veinstones are cooler than those above them." Mr. Henwood suggests that observations should be directed to the extent to which the shafts and galleries of mines disturb the ordinary course of transmission of heat towards the surface of the earth due to "the composition and structure peculiar to different strata," and to "the conducting power proper in various degrees, to all rocks" (p. 763).

The appendix No. 2 illustrates, by numerous and elaborate tables, the proportion of solar heat absorbed by the ground. The spot on which these observations were carried on was at Agoa Quente (some 3600 ft. above the sea), in Brazil, at depths of 3, 6, and 9 ft. from the surface. All these extensive observations by Mr. Henwood, in so many different regions, and dealing with so many different conditions, verified by tables bearing testimony to the most astonishing labour, afford admirable example of the mode of enquiry necessary towards determining the mean temperatures and ratios in any one vertical line—a problem to the solution of which the abilities of some of our most distinguished members has been long since directed. (Hear.)

Mr. Henwood's results have been obtained—first, by placing thermometers in holes in absolutely dry places; secondly, by placing them in streams of water immediately on their issuing from the various rocks and veins; every care being taken to secure the accuracy that might be expected from so experienced an enquirer. There can be no doubt that this volume will add largely to Mr. Henwood's already high reputation, and shed additional lustre on our "Transactions." (Applause.)

My justification for having thus attempted, however imperfectly, to give some idea of its contents is that I may make known to those who study the question treated of in this great work what a storehouse of information it contains, of the greatest importance to all engaged in directing mining operations throughout the world, or interested in some of the most abstruse problems which those employments involve. (Applause.)

FOREIGN MINING AND METALLURGY.

The report of the directors of the Bochum Steel Manufacturing and Mining Industry Company indicates a favourable state of affairs. After deducting about 190,000 thalers devoted to renewal purposes, the net profit remaining is 213,741 thalers, admitting of a dividend at the rate of 10 per cent. per annum. Employment is stated to be assured for some time to come to the company's steel foundry. During the last exercise the production of the company increased to the extent of 40 per cent., and the company devoted about 180,000 thalers to an extension of its establishments. The company is now issuing a 6 per cent. mortgage loan of 300,000 thalers; of this loan about 120,000 thalers have been already subscribed. The Hoerde Mining and Metallurgical Company is about to pay a dividend at the rate of 8 per cent. per annum for 1869. The Germano-Dutch Metallurgical and Mining Company (at Duisbourg) will not distribute any dividend for 1869-70.

The orders for rails recently given out by the Belgian Government on account of the State lines are nearly the only new commands of any importance which have been received by the Belgian rail mills; at the same time some minor current orders have come to hand. The total imports of steel of all kinds into Belgium in the first seven months of this year amounted to 2938 tons, against 2291 tons in the corresponding period of 1869. The imports of minerals into Belgium in the first seven months of this year amounted to 385,773 tons, against 319,463 tons in the corresponding period of 1869. In the total of 385,773 tons the Zollverein figured for 243,715 tons, France for 130,327 tons, and the Low Countries for 11,415 tons. Of raw pig and old iron, Belgium imported during the first seven months of this year 55,890 tons, against 28,339 tons in the corresponding period of 1869, or nearly double; England furnished almost the whole of these supplies. Of rails, plates, and other descriptions of hammered iron Belgium imported in the first seven months of this year 3726 tons, against 2172 tons in the corresponding period of 1869. The exports of minerals from Belgium in the first seven months of this year amounted to 114,154 tons, against 92,232 tons in the corresponding period of the year 1869. France figured in this year's total for 84,854 tons, the Zollverein for 22,605 tons, and the Low Countries for 6602 tons. The exports of rough pig, old iron, and wire from Belgium amounted in the first seven months of this year to 5561 tons, against 11,000 tons in the corresponding period of 1869. The exports of rails from Belgium experienced a slight decrease in July, but for the seven months ending July 31 this year they still showed an increase of 2498 tons; as compared with the first seven months of 1868, the increase was 48,183 tons. During the first seven months of this year Belgium exported 34,076 tons of rails to Russia, against 35,548 tons in the corresponding period of 1869; to the Zollverein, 19,421 tons, against 3183 tons in the corresponding period of 1869; to Turkey, 14,311 tons, against 23,278 tons in the corresponding period of 1869; to France, 4178 tons, against 476 tons in the corresponding period of 1869; to Italy, 4289 tons, against 10,459 tons in the corresponding period of 1869; to the United States, 3780 tons, against 5923 tons in the corresponding period of 1869; to Sweden, 1700 tons, against 730 tons in the corresponding period of 1869; to Spain, 2437 tons, against 36 tons in the corresponding period of 1869. Of plates and other descriptions of iron the exports for the first seven months of this year amounted to 73,413 tons, against 70,262 tons in the corresponding period of 1869. To sum up, we may give the annexed table, which shows the exports of iron of every description from Belgium during the first seven months of this year to every country with which Belgian metallurgical industry maintains commercial relations; the corresponding exports for the first seven months of 1869 are also given:—

Destination.	1870.	1869.
Russia	Tons 39,574	Tons 39,440
Sweden and Norway	1,842	733
Denmark	53	579
Zollverein	34,391	22,840
Hanse Towns	2,604	2,660
Low Countries	13,147	16,358
England	6,913	7,563
France	25,916	23,562
Spain	2,903	299
Italy	6,420	12,519
Switzerland	2,809	2,007
Austria	1,163	1,320
Roman States	35	28
Turkey	16,217	23,860
Egypt	1,480	29
United States	5,663	9,411
Cuba and Porto Rico	1,076	653
Brazil	324	580
Rio de la Plata	95	440
Chili and Peru	273	327
Other countries	72	294

The aggregate for the first seven months of this year was thus 163,370 tons, against 165,508 tons in the corresponding period of 1869.

The Belgian coal trade has experienced no improvement. Some deliveries have, however, been made to the French Ardennes, and some supplies have been laid in of coal for domestic purposes. The extraction has not yet been materially reduced, and wages are maintained at a tolerably satisfactory rate, having regard to all the circumstances. In the Charleroi basin coal prices vary greatly, according to quality. Advices from various points show that colliery proprietors and boat owners are preparing actively to profit from the great revival which is anticipated in affairs upon the conclusion of peace, a contingency which, happily, does not now appear to be very remote. It is expected that scarcely any German coal will be imported into Belgium for some time to come, as the extraction of the Westphalian collieries has been greatly reduced, in consequence of all the younger members of the working classes having been called to arms. The Westphalian production has, under these circumstances, been so considerably reduced that, notwithstanding the crisis in affairs, the supply of coal available for the wants of local industry is now considerably below its actual requirements. This state of things threatens to continue for some time, and the price of coal has, in consequence, experienced a considerable advance, which threatens to continue. As an illustration of the situation, it may be mentioned that the Gelsen-Kirchen Colliery recently accepted a contract to extend over the whole of 1871, at 10s. 2½d. per ton; the same company was selling before the present crisis at about 5s. 5d. per ton. Belgian coalowners will thus, in all probability, profit materially on the conclusion of peace, from the difficulties which their neighbours are experiencing in procuring the coal required for their industries; this remark applies to the French as well as to the Germans.

It appears from official returns that during the first seven months of this year Belgium imported altogether 135,368 tons of coal, of which 49,315 tons came from France, and about 70,573 tons from England. The Zollverein and the Low Countries sent Belgium about 15,500 tons. The corresponding aggregate imports for the first seven months of 1869 were 139,317 tons. The importations of coke into Belgium in the first seven months of this year amounted to 6005 tons, against 4119 tons in the corresponding period of 1869. The exports of coal from Belgium in July amounted to 327,781 tons, against 266,069 tons in July, 1869; this result was decidedly favourable, but equally satisfactory figures will not be presented for August, September, and the current month. In the first seven months of this year coal was exported from Belgium to the extent of 2,171,928 tons, against 1,906,892 tons in the corresponding period of 1869, and 1,993,126 tons in the corresponding period of 1868. As hitherto, so in July, France was the principal outlet for Belgian coal, having taken in July 307,242 tons, and during the first seven months of this year 2,079,380 tons, against 1,829,036 tons in the corresponding seven months of 1869. The exports of coke from Belgium in the first seven months of this year amounted to 423,376 tons, against 367,874 tons in the corresponding period of 1869; nearly the whole of these exports were made to France and the Zollverein. The value of the increased exports of coal and coke made by Belgium this year amounted to something over 200,000*l.*

Advices as to the Marseilles copper market quote Toka at 76*l.*; Spanish, 68*l.*; refined Chilian and Peruvian, 76*l.*; rolled red copper in sheets, 80*l.*; round ditto, 82*l.* per ton, the whole for consumption. The German copper markets remain very quiet. In Holland former rates for copper have been about maintained, Drontheim making 50 fls. to 52 fls. The German tin markets have been quiet. At Rotterdam tin has been feeble; some transactions in Banca have taken place at 73¼ fls. to 74 fls., on the conditions of the late sale. Arrivals of Billiton have been reported to the extent of about 8000 ingots; for the present, however, scarcely any of these lots have been thrown on the market. The tendency of the lead markets is towards improvement; upon the German centres there has been a little more doing, especially at Berlin. At Rotterdam, Stolberg and Eschweiler have made 11 fls., and German lead of various marks has brought 10¾ fls. Business has been much restricted in zinc. At Marseilles the quotation for rolled zinc is 28*l.* per ton.

THE SOUTH AFRICAN DIAMOND FIELDS.

An interesting little pamphlet, intended as an Emigrants' Guide to the South African Diamond Fields, by Mr. James Gill, M.A., has just been issued by Messrs. Sampson Low, Son, and Marston, and will doubtless prove of considerable utility to those for whom it has been provided. Mr. Gill, although a graduate of Cambridge, has long been connected with Graaf Reinet College in the Cape Colony, and has taken the opportunity of making such use of his leisure, by hunting excursions and otherwise, that he must be well qualified to pronounce an opinion. He remarks that about two years since the news thrilled through the colony that a diamond had been picked upon the banks of the Orange river had been tested in Cape Town, and valued at 500*l.* The diamond was purchased by Sir Philip Wodehouse, Governor of the colony. Shortly after this another diamond was found by a Kafir, sold to his employer for a few hundred sheep and goats, and re-sold by him to a mercantile firm for 11,300*l.* This diamond—the "Star of South Africa"—was sent to Europe to be cut and polished, and is said to have been purchased by the Prince of Wales for 25,000*l.* But it was only a few months since that a real business like search was commenced; yet the excitement in the colony has already reached fever point. Mr. Gill remarks that the climate of the Cape Colony is during nine months of the year magnificent—the winter cold just keen enough to make a sharp walk enjoyable, the spring and summer temperature so delicious that it is a luxury to breathe, but the summer months (December, January, and February) are a little too warm; yet he has more than once hunted through a long summer's day with his rifle on his shoulder and felt none the worse for it.

In their richness, their promise, and their magnitude Mr. Gill considers the South African diamond fields to surpass all other diggings on record. There is abundance of ground for thousands of men to work, and he thinks that the present generation is not likely to see an exhaustion of the fields. There are many buyers on the ground, and money is abundant. Mr. Gill suggests that diggers should go in clubs of six, with at least 250*l.* capital between them; in addition to which an outfit costing 300*l.* more will be required. He admits that the hunt for diamonds is a lottery, but does not believe that there ever was a lottery with so many and such rich prizes, and so few blanks. He advises the emigrant to land at Port Elizabeth, make the best of his way to Graaf Reinet, taking nothing with him but a change of clothes, a small filter, a rifle, and a revolver. A passenger cart plies between Port Elizabeth and Somerset (fare 3*s.*) The post cart will take him on to Graaff Reinet for 30*s.* About 50 lbs. of luggage allowed in either case. This is a pleasant and expeditious route, and the journey over the Zumberg mountains, the scenery of which is magnificent, will at once put him in love with the country. If there should be any difficulty, he continues, about the Somerset passenger cart (the service will probably be increased before long), let him get cart and horses and come by the direct route to Graaff Reinet. The journey by either of these routes occupies at the most three days. Wagon travelling is horribly tedious, and the possible mishaps from oxen dying, detention by flooded rivers, &c., are many. But before investing in cart and horses, take someone into your counsel who knows the country. As a general rule, don't rely too much on your own wits; they may be keen enough for northern climes, but they will require an extra sharpening on this side of the equator.

The Cape Colony, and the Diamond Fields.—In an interesting communication from a firm of high standing in the colony to its London representative, it is stated that the general quality of Cape diamonds, the result of surface scratching, is said by Mr. Unyer, from Hamburg, to be superior to the stones from Brazil found at a depth of 20 feet. As yet diamonds have been found almost indiscriminately, sometimes in the gravel in flats, sometimes (and generally of richer quality) in the summit of kopjis in the gravel below the basaltic boulders. The general character of the rock is metamorphic, trappean, and conglomerate, but the surface soil varies greatly. On the whole, the general characteristics more resemble the Indian than the Brazilian diamond regions. It is quite true that the pebbles of quartz and other matters between the boulders are water worn, the result of successive floods; still everything would indicate the deposit of diamonds as resulting from a general upheaval, and having been probably deposited in rock, which may have disappeared. It is considered, from the most reliable scientific reports made, that reviewing the general aspects of the country, it by no means follows that the true habitation of the diamond will be found in the course of the great rivers, but probably extends over many hundred miles, and we confidently expect that we are only on the fringe of far richer discoveries, which will furnish profitable employment to many more people than we are likely to have for a long time.

Text Books of Science.—A rewritten and enlarged edition of Prof. Goodeve's "Elements of Mechanism," has just been issued by Messrs. Longmans, as the first of a series of text books adapted for the use of artizans and students of applied mechanics. The editorship of the series has been entrusted to Prof. Goodeve, whose long experience at King's College and the Royal School of Mines must have given him the best possible opportunity of ascertaining the precise kind of work best suited to the requirements of students. To those intending to compete for the Whitworth Scholarships the books will be invaluable. It is explained that the books will not be mere manuals for immediate application, nor University text books in which mental training is the foremost object, but are meant to be practical treatises, sound and exact in their logic, and with every theory and every process reduced to the stage of direct and useful application, and illustrated by well-selected examples from familiar processes and facts. With regard to the quality of the of the books it will suffice to state that Prof. Goodeve's collaborateurs are Mr. Merrifield, F.R.S., Principal of the Royal School of Naval Architecture, the Rev. W. N. Griffin, Rev. H. W. Watson, Profs. Shelley, Stokes, Fleeming Jenkin, Twisten, Bloxam, and the late W. A. Miller, particular care having been taken to allot to each that subject to which he has specially devoted himself. To judge from Prof. Goodeve's volume the series will leave little to desire, and Messrs. Longmans hope that practical utility will be combined with sound theory will be fully realised.

Invisible Postal Ink.—The system of open correspondence, which the late introduction of the new post cards has created, has suggested to Mr. J. Luntley, of Fore-street, the desirability of providing the public with a means of corresponding in such a manner that the inquisitiveness of those through whose hands the cards pass can be at once detected. By the use of the new ink, which is quite colourless, the correspondence written on the post card remains invisible until the card is exposed to a strong heat by the fire or gas; it then becomes a jet black. The ink is likely to be extensively used.

Challenge to the World.—The *Bristol Daily Times and Mirror* Aug. 15th, has the following: Messrs. J. C. Swan and Co., of 16, Queen-square, in this city, have invented a pocket microscope, which is a marvel in all that such an instrument should be. It has great power, remarkable definition, and does not require focussing. The cheapness of the article will make it exceedingly popular when its merits are more widely known. It is called the "Bristol Microscope," and is a great credit to the inventor, as much for its extreme simplicity as its power.—The *Western Daily Press* says: The Bristol Microscope has a magnifying power of 20,000 times, &c.—The *Western Daily Telegraph* says: The Bristol Microscope is the most compact and useful scientific instrument we have ever seen; it possesses extraordinary power, and is very easily managed, &c. The price of the Bristol Microscope is only 2*s.*, or free by post, with printed directions, for 28 stamps.—Address, J. C. Swan and Co., Opticians, 16, Queen-square, Bristol.

FOREIGN MINES.

Don Pedro North del Rey (Gold).—The directors have rece
the following telegram from Lisbon:—"Produce weighed to Sept. 29, 3719
estimate for September, 5217 oits."

Battle Mountain.—Wm. Nancarrow: Virgin Lode: The
level has been driven from the shaft 150 ft.; the lode is still large, but of no
at present. We are still pushing it on by four men day and night. The
in the back of this level (73 ft.) does not look so well, and the ore we are
out requires much more sorting. In the winze sinking below the 73 ft. lev
lode continues still over 6 ft. wide—a splendid course of ore, now down 1
—Lake Superior: In the Lake Superior we are driving north and south;
ends are producing a good quantity of sacking ore, and looks promising
improve.—Hallow's Ledge: The lode at this shaft, on Hallow's Ledge,
large, and producing some very rich ore, but not yet a real course of ore
shaft is down 58 ft. I hope by Thursday, the 6th inst., to ship at the s
1000 sacks of ore, all from the Virgin, that is if we can get it down; it
taken out of the mine now, but I hear that one of the teams has broken
on the way.

Cape (Copper).—Capt. Williams reports for September—Oo
The engine-shaft during the past month has been very hard and troubl
for sinking; several of the men being laid up with severe cold has delay
progress which otherwise would have been made; the ground sunk in th
month is 1 ft. 10 in. Re-set Sept. 1 to three men and six labourers, at 7
fathom, for 2 fms., or the month. The 40, south-west from No. 6 winz
been extended 5 fms. 3 ft. during the past month in a good course of copp
that yielded from 7 to 8 tons per fm.; the end at present is not looking s
but will still yield from 2½ to 3 tons per fm.; we have taken the men fro
end, and put them to stope in the back of the 40, to enable us to keep u
samplings. The two stopes working in the back of the 40, by two men a
labourers, at an average price of 3*l.* 10*s.* per fm. for each stope, will yield
8 tons of copper ore per fathom.

The 30 fathom level east, on Job's branch, has been extended during th
month 3 ft. 4 in., through ground that has produced some good stones of
ore; the end at present is looking very kindly, and is promising for furth
provement. The winze below the 20, on Job's branch, has been sunk duri
past month 2 ft. 4 in., through ground that has produced some good sto
copper ore; the end at present is looking very kindly, and is promising fo
ther improvement. The winze below the 20, on Job's branch, has been
during the past month 3 ft. 4 in., which has produced some good saving
at present it is looking very promising. The 24, north from the east lev
been extended during the past month 1 fm. 9 in., in a good course of copp
the end at present is poor, in a hard floor of quartz rock, which I think
temporary. The three above-mentioned bargains are suspended for the p
and the men put stoping, in consequence of being short of hands, in or
keep up our sampling until such time as we have an increased supply of
when we hope to resume these bargains.

The three stopes in the back of the 30 fm. level, by three men and fift
bourers, working at an average price of 3*l.* 1*s.* 8*d.* per fathom, will yiel
7 to 8 tons of copper ore per fathom. Two stopes in the bottom of the
level, and one in the back, worked by three men and fifteen labourers,
average price of 3*l.* 1*s.* 8*d.* per fathom, will yield from 7 to 8 tons per fa
The winze below the 20 fm. level during the past month has been sunk
2 in., in unproductive ground, and have about 6 or 8 ft. more to sink t
municate with the 30 fm. level, which will make it very convenient for w
this part of the mine. I am sorry to say our sampling will be short of th
quantity (500 tons) again this month, for want of more miners and m
bourers. I have no doubt we shall make up the whole amount of ore by
of the year, by employing all our forces in breaking ore, as we now hav
I am pleased to remark that I never saw the mine looking better than
present. August extract, 385 tons of 21 cwts.

Spectakel: The incline sinking below the 27 will yield for the length
incline (14 ft.) about 6 tons per fathom; we have about 2 fathoms more
to be deep enough for the 36, where we shall have a plat to cut and a plun
to fix, which will take from two to three months to complete. The s
the bottom of Harvey's pitch will yield about 3 tons of copper ore per fa
The three stopes in the bottom of Arend's pitch will each yield from 3 to
of copper ore per fathom. The stope in the bottom of the 27 will yield
3 tons of copper ore per fathom, also the stope in the back of the 27 wil
about 3 tons per fathom. The 27, both north and south, on the flookan
will each yield about ½ ton of very rich copper ore per fathom.

The surface operations by the end of this month will be very nearly com
we hope then to be able to lessen the cost and increase our returns. We
short of miners and mine labourers in this mine to carry on the work
as we could wish. August extract, 110 tons, of 2240 lbs. Transport for A
893 tons. Bills of lading received for 323 tons, per Lynwood, and 537 to
Limena. Thirty good miners are being sent out from England.

Exchequer.—Lewis Chalmers, Sept. 26: Bulliona: The air
shift was raised 6 ft. last week, and two sets of timbers were put in, th
being now up 106 ft.; the shift cross-cutting from the 100, in the north
from the 50 ft. level in winze, made 7 ft., and sent up on an average 70 t
of water per day, each bucket containing 30 gallons. The drift is in 1
reddish quarts. The winze shift have put in a platform at the 80 ft. le
stull pieces, and run 4 ft. of a drift north in good ore. They have sent up
loads, 5½ of which were ore, chiefly second-class. Each bucket holds 5
and the car will hold 3½ buckets. About 40,000 ft. of logs have been cu
of the spur-gearing has arrived for the alteration of the saws to the engi
the roofing of the assay office and bullion smelting room has been comm

[For remainder of Foreign Mines see to-day's Journal.]

Bronfloyd.—The Stock Exchange Committee have ordere
marking of these shares in the Official Lists. This company deserved t
knowledgment of its stability; it has been working a lead mine regulari
1852, latterly with eminent success, and so much so that its property is n
puted to be the most profitable in Cardiganshire, and, considering the le
ground as yet developed, is perhaps even the best in the Principality.
quite lately the mine was held by a few gentlemen, so that the compan
more like a private one, but on the sub-division of its shares from 1000 to
purchasers came in, and the capital, 50,000*l.*, is now represented by a
fluential proprietary, numbering, we believe, upwards of 240: 30,000*l.*
capital was added free by way of bonus in May last, and the shares are
further liability. The proprietary have already received 49,000*l.* in div
and bonus; and the 28th quarterly dividend will be declared at the meet
be held on the mine on the 26th inst. The manager confirms the discov
ticed last week, made at the lowest point of the mine—84 fms. from s
The ore ground between this level and the next one above (11 fms.) is est
at 30,000*l.* value, which is equivalent upon the past year's returns and
four and a half years' profits upon this part of the mine alone, whereas
additional depth of this shaft is regularly accomplished every year,
which some of the higher levels are yielding 3 tons, or say 40*l.*, of lead
cubic fathom, broken away at an average of 3*l.* per fathom. The spir
which these works has been conducted has often been noticed in thi
nal, and it will be sufficient proof of the fact when we state that at the p
time the company has two shafts in actual sinking, in addition to th
shaft, of which, as just noticed, a lift (10 fathoms) is put down, and a
level driven every summer.

If the market value of mine shares were always in proport
the prospects of the mine the adventurers in Wheal Grenville wou
but little cause to congratulate themselves, but not unfrequently mines
or no intrinsic value are by clever market manipulations raised to an en
figure, whilst a property possessing excellent prospects is selling at a
lously low figure. Wheal Grenville is of the latter class, and at the
moment is one of the cheapest and best tin speculations of the day. A f
remarks will show that this is no baseless opinion. The mine is now mo
meeting its costs, and if the bunch of tin discovered in the 90, and wo
per fathom, should be met with in the 100, of which there is every rea
prospect, the tin returns would be considerably increased at once.
also another good point in the cutting in the 66 of the main part of th
which appears to have diverged in a northerly direction. The chief poi
ever, is the intersection of the South Condurrow lode; and here, witho
least wishing to disparage the present position of South Condurrow, th
prospects of that mine are much inferior to those of Wheal Grenville.
in the westeru part of South Condurrow, and immediately adjoining
Grenville, has a very rapid underlie, and at a comparatively shallow de
fall into the latter sett. The management of Wheal Grenville, fully alive
importance of this feature, have for some time past been vigorously de
120 fm. level, with a view to the intersection of the lode. That the lode
met with there is scarcely a doubt, and should it be found as good as
South Condurrow, Wheal Grenville would quickly become a dividend m
the shares in all probability reach a very high figure. Until this most im
feature is proved the adventurers will best consider their own interest
ing no heed of the low quotations of the shares, to listen to no adverse
of the mine, but to hold on to their shares.

Moulding Metals.—Messrs. W. and R. Mushet, Dalkei
prepare a "pattern" or pattern plate of the article to be cast from
iron, wood, or any other suitable material in the following manne
pattern is placed upon a suitable plate or board set upon a deep and
of sand. A moulding box about 6 in. larger than the pattern every way
placed upon the plate or board; the pattern or patterns being set fa
middle it is rammed up and turned over on another solid bed of sa
board is then removed and the parting carefully made. The top part o
is then put on to the part already rammed up, which is the drag; the
are put in suitable places, and this also is rammed up. The two parts
separated and a frame of wood about ¼ in. thick and 1½ in. broad
on the parting, keeping the pattern fair in the middle.

Rotary Engines.—By the invention of Mr. A. Ripley,
wark, the driving-shaft is supported in suitable bearings, and has att
it, so as to turn with it, and on the same centre, two concentric cylin
inner of these cylinders being considerably smaller in diameter than t
but of equal width or depth. Both cylinders are completely closed on
at which they meet the shaft, but open at their opposite side. These c
are also connected by a plate or radial arm of the same width or dep
cylinders, so that at their open side their end surfaces and that of the
arm are exactly flush. The plate or arm acts as the piston.

Getting Coal.—The invention of Mr. R. S. Norris, Liv
consists in improved single and multiple drilling machines for drilling
series of holes in the sides of the seam of coal. Each drill is fastened in
holder working in a carriage fitted to a bed or frame, so that it can slid
fro, and in the carriage and standards on the bed or frame there is a scre
ing toothed wheels, gearing into other toothed wheels on one or mo
holders, and when revolving motion is given to the screw, revolving and
ing motions are given to the drill or drills at the same time, the carriage
on the bed at the required speed.

London: Printed by Richard Middleton, and published by Henry E
(the proprietors), at their offices, 26, Fleet Street, E.C., where all
nications are requested to be addressed.—*October* 29, 1870.